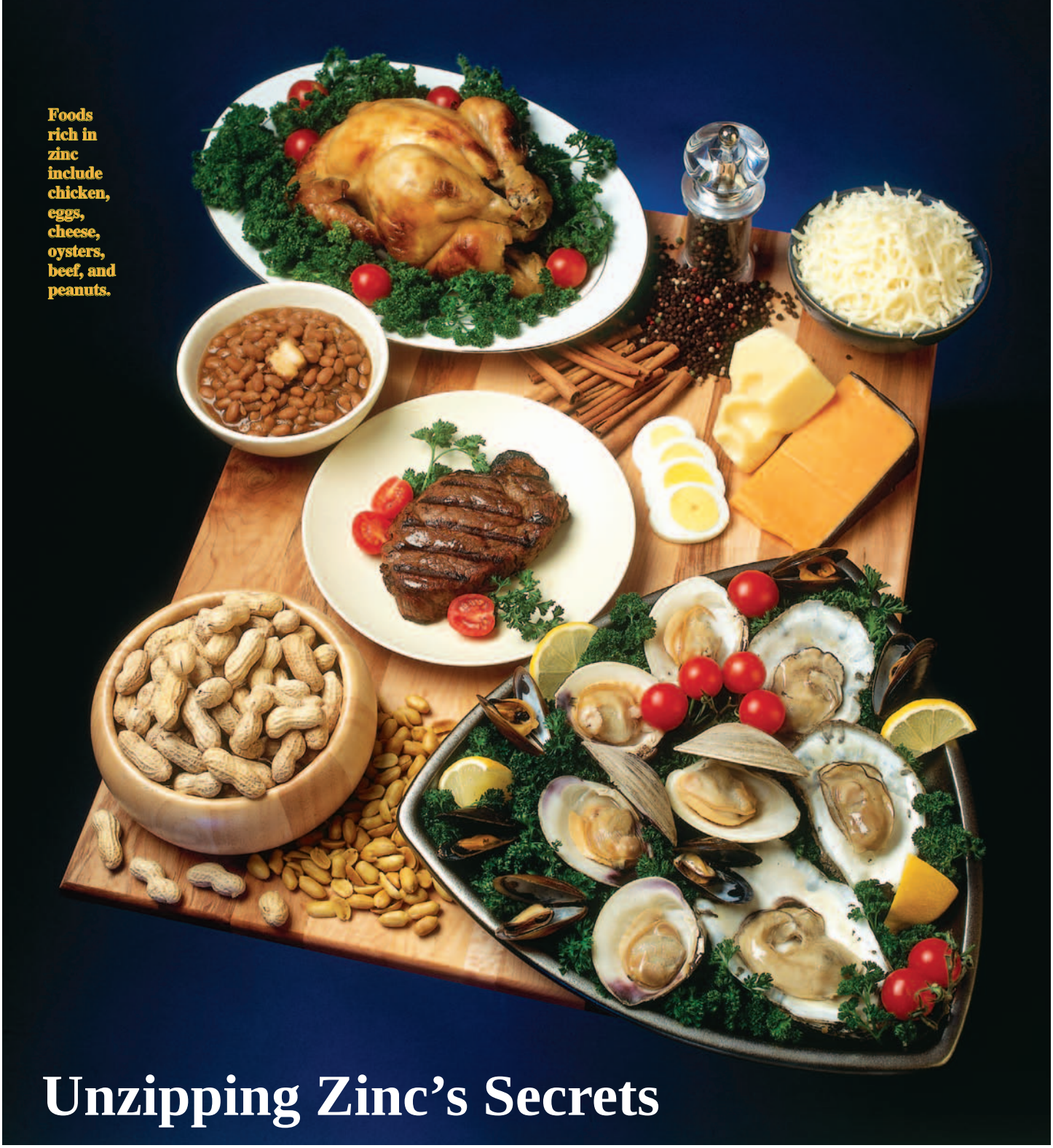

Foods rich in zinc include chicken, eggs, cheese, oysters, beef, and peanuts.

KEITH WELLER (K9834-1)

Unzipping Zinc's Secrets

Without zinc, we couldn't survive.

We rely on this mineral to help us taste and digest our food, to grow properly, and even to breathe. It's especially important in the development of boys into men. What's more, we need zinc to help decode the instructions in our genetic material, DNA. Our bodies use these instructions to make the proteins that keep all our complex internal systems running smoothly. Zinc is an essential component of about 400 of these proteins.

Despite zinc's vital role in our health, our bodies need only trace amounts: Adults require from 8 to 11 mg a day for good

health. That's about the amount in your favorite zinc-enriched breakfast cereal—such as specially fortified cornflakes or raisin bran—or in a sizzling, 6-ounce beef chuck steak, for instance.

Certain seafoods, notably oysters, along with milk, whole-grain breads, dark-meat poultry, and nuts like cashews also provide this multipurpose mineral.

Though zinc's interactions with cells and molecules are extensive, our knowledge of this mineral is not. National recommendations for Americans' daily intake of zinc only date back to 1974, 30 years later than those for some other essential metals.

Zinc: A Chemopreventive?

Scientists have known for decades that zinc may play an important part in the health of the prostate, a walnut-sized gland in males, located near the bladder. The prostate secretes a zinc-containing liquid that's a component of seminal fluid.

At the ARS Western Human Nutrition Research Center in Davis, California, ARS research geneticist Liping Huang is zeroing in on the role that zinc in the foods we eat may play in helping men reduce their risk of prostate cancer.

"Clinical evidence has indicated that cancerous prostate cells contain less zinc than healthy prostate cells," Huang says. But scientists don't yet have enough evidence to prove that an increase of zinc in cancerous prostate cells may help prevent their proliferation.

"Other studies conducted in the United States with healthy men have shown that they had much more zinc in the prostate than in other soft organs, such as the liver and kidneys," she says. "But no one knows for certain why that's so."

Huang recently led a study in which she compared the amounts of zinc taken up by the prostate's epithelial cells. She used noncancerous and cancerous human cells that had the same genetic source, or genotype.

That's a critical basis for a well-founded comparison, because natural differences in our genetic makeup can influence our ability to take up and use—or metabolize—nutrients in food, including zinc.

These differences are at the heart of the newly emerging field of nutritional genomics, or nutrigenomics. This leading-edge discipline is a new take on genomics—the investigation of all the genes in an organism.

Huang's study provides new details about zinc's possible role in preventing cancerous prostate cells from proliferating and spreading. The research was funded by ARS and a grant from the National Institutes of Health's National Center on Minority Health and Health Disparities.

Huang and co-workers cultured cells in a liquid in laboratory dishes, then exposed them to zinc for 2 days. The scientists used zinc sulfate for this phase of the experiment.

The result? "The cancerous cells accumulated about one-third less zinc than did the noncancerous cells," Huang reports.

The team also looked for significant differences in levels of zinc transporter proteins. These specialized proteins ferry zinc throughout the body, such as from storage in the liver, kidney, or bone to other sites. The amount of one such zinc transporter protein—ZIP1—was reduced in the cancerous cells. As a result, those cells had low ability to take in zinc.

ZIP3: In the Wrong Place

In addition, their analyses showed that even though a second zinc transporter protein, ZIP3, was present in the cancerous cells, it wasn't in its correct location. Says Huang, "This error may have blunted any of ZIP3's potential protective effects."

Huang explains that the study "provides the first direct comparison of zinc-transporter-protein levels in noncancerous and cancerous prostate epithelial cells with the same genetic background and the first evidence of significant differences in the levels and localizations of the proteins.

"Though these results are preliminary, they suggest that reduced levels of one transporter protein and mislocation of another may play a role in cancer's progression in the prostate."

To learn more, the team developed another experiment with ZIP1, artificially stepping up its manufacture in the cancerous cells. Says Huang, "We did that by overexpressing the genes that cue production of this protein.

"Overexpressing ZIP1 significantly suppressed growth and spread of the cancerous cells," she reports. "We don't yet have enough evidence to say with certainty that zinc in our foods acts as a chemopreventive. But zinc's natural abundance in the prostate of healthy men, and its performance in our tests, suggest it may be an important natural defense."

With further research, perhaps that role will be added to zinc's already impressive list of life-giving tasks.—By **Marcia Wood,** ARS.

This research is part of Human Nutrition, an ARS National Program (#107) described on the World Wide Web at www.nps.ars.usda.gov.

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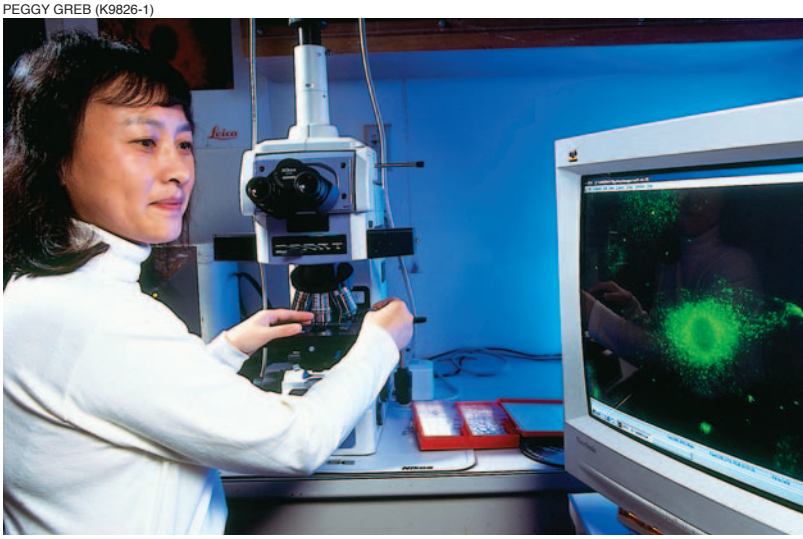
PEGGY GREB (K9826-1)



Geneticist Liping Huang's studies of zinc in prostate cells may reveal more about the role of this nutrient in human prostate health.